Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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OFFICE OF SECRETARY

In the Matter of	)	IB Docket No. 95-91
	)	GEN Docket No. 90-357
Establishment of Rules and Policies	)	RM No. 8610
for the Digital Audio Radio Satellite	)	PP-24
Service in the 2310-2360 MHz	)	PP-86
Frequency Band	)	PP-87

REPLY COMMENTS OF CRACKER BARREL OLD COUNTRY STORE, INC.

CRACKER BARREL OLD COUNTRY STORE, INC.

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Dated: October 13, 1995

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Cracker Barrel Old Country Store, Inc. ("Cracker Barrel"), by its attorneys, submits its Reply Comments in response to the Comments filed regarding the Notice of Proposed Rulemaking ("NPRM") in the captioned proceeding. In the NPRM, the Federal Communications Commission ("Commission") seeks comments on the rules and policies that should apply to satellite-delivered Digital Audio Radio Service ("DARS").

I. INTRODUCTION AND SUMMARY

In its initial Comments filed in this proceeding, Cracker Barrel indicated its interest in constructing and operating a DARS satellite system for the purpose of providing entertainment and informational services to automobile travelers. In order to encourage innovation, Cracker Barrel urged the Commission

to create an environment in which competition among DARS satellite operators would be maximized. Therefore, Cracker Barrel supported a reopening of the previous application filing window. Further, Cracker Barrel emphasized that more than the current four applicants could be accommodated in the available bandwidth using state-of-the-art transmission technologies and progressive policies such as multiple licensing.

The Comments filed by the existing applicants treat this emerging field as if it is theirs to dominate. Their joint filing approaches this proceeding as if it were a negotiated rulemaking in which their own resolution of the issues should be considered the satisfactory result. Cracker Barrel acknowledges the early interest of these four applicants and their contribution to the development of the field. However, crucial public interest considerations raised in the NPRM, including the number of DARS competitors to be licensed, may conflict with the incumbents' more self-interested outlook.

In this reply, Cracker Barrel demonstrates that:

- The Commission may reopen the cutoff pursuant to a public interest finding.
- Using TDM, at least 6 national licensees providing 30 CD-quality channels each can be accommodated in the band.
- Using CDM, at least 6 national licensees providing 32 CD-quality channels each can be accommodated in the band.
- The number of licensees using TDM or CDM may be doubled if a higher order modulation constellation is feasible.

- The existing applicants have not adequately supported their assertions concerning the number of channels required per licensee.

II. THE FCC MAY LAWFULLY REOPEN THE DARS APPLICATION WINDOW

The current applicants fail to support their position that the cut-off on filing of additional DARS applications cannot be reopened. CD Radio's reliance on Ashbacker is misplaced. 1/ Ashbacker holds that the Commission may not render meaningless a party's statutory right to a hearing by granting a mutually exclusive application before the hearing has taken place. Since Ashbacker, cut-off rules have been employed to ensure that the right to a hearing is not effectively denied. Ashbacker does not establish any prohibition on the reopening of cut-offs. Setting a new cut-off date does not deny an applicant a hearing. Its only effect is to potentially expand the number of applications under consideration.

The primary purpose of a cut-off is to promote administrative finality. "The essential basis of the cut-off rules is . . . the public's interest in having . . . licenses issued (and service provided) without undue delay . . . ." 2/ In addition, the Court has stated that applicants are entitled to a certain "protected status" -- to be aware of competing filers so as to enable them to prepare for the upcoming selection

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1/ Ashbacker Radio v. FCC, 326 U.S. 327 (1945).

2/ Florida Institute of Technology v. FCC, 952 F.2d 549, 554 (D.C. Cir. 1992).

hearing. 3/ "Protected status" does not mean that the early applicants are shielded from additional filers under any and all circumstances.

The current applicants cite several cases in which the Commission refused to reopen a cut-off period. 4/ But those cases do not support the current applicants' contention that the Commission is prohibited from accepting additional applications. Instead, those cases demonstrate that the Commission has discretion under the public interest standard to consider whether to reopen filing periods. City of Angels is instructive here. In that case, the Court found that the Commission did not abuse its discretion when it declined to allow intervention, waive an application cut-off date, and reopen a comparative licensing proceeding. 5/ The Court did not hold that the FCC would be barred from reopening the proceeding; it simply concluded that the FCC did not abuse its discretion in not doing so. 6/ The Court specifically stated that it "obviously" did not "mean to suggest that that the cut-off rule gives timely applicants a vested right against

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3/ City of Angels Broadcasting Inc. v. FCC, 745 F.2d 656, 663 (D.C. Cir. 1984) (quoting Ranger v. FCC, 294 F.2d 240, 243 (D.C. Cir. 1961)).

4/ E.g., Florida Institute of Technology v. FCC, 952 F.2d 549 (D.C. Cir. 1992); Coalition for the Preservation of Hispanic Broadcasting v. FCC, 893 F.2d 1349 (D.C. Cir. 1990), rev'd on other grounds, 931 F.2d 73 (D.C. Cir. 1991) (en banc); City of Angels Broadcasting Inc. v. FCC, 745 F.2d 656 (D.C. Cir. 1984); Sacramento Community Radio, Inc., 8 FCC Rcd 4067 (1993).

5/ City of Angels, 745 F.2d at 662-664.

6/ Id. at 662-67.

challenge from untimely competitors. . . . It is, however, manifestly within the Commission's discretion to consider the effects that acceptance of an overdue filing would have upon timely applicants." 7/ The circumstances in the DARS proceeding weigh in favor of reopening the cut-off.

The current applicants attempt to show that cut-offs have been waived by the Commission only under special conditions. 8/ The fact that waivers have been issued only proves the point that the Commission may determine in particular cases that concerns about administrative finality or about the effect on existing applicants are outweighed by other public interest factors. As the Commission ruled in Alabama Citizens for Responsible Public Television, cut-offs may be waived in "unusual and compelling circumstances." 9/

The DARS proceeding is just such a case. Here the application filing period was established long before radio frequencies were allocated for the proposed new service. The cut-off was set prior to the establishment of the service itself and of the rules that will define the nature of the service, and prior to a determination

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7/ Id. at 663 n.7.

8/ See Comments of CD Radio at 24-28.

9/ Alabama Citizens for Responsive Public Television, 53 FCC 2d 457, 460 (1975) (quoting Bronco Broadcasting Co., Inc., 50 FCC 2d 529 (1974)). In that case, the FCC noted that the essence of the question was "whether the public interest will be sufficiently enhanced by the opportunity to choose between competing applicants to outweigh such considerations as administrative practicality and notice to other applicants." Id. at 462.

as to how many licensees should be authorized. This proceeding is considering whether there should even be a DARS service. The current applicants cannot properly claim that they are entitled to certainty when the very existence of the service, and its parameters, are themselves uncertain.

These are "unusual and compelling circumstances" justifying the reopening of the cut-off. There should be no effect on administrative finality as the Commission does not intend to act on DARS applications until the fundamental policy issues are settled. Moreover, the public interest in receiving the most diverse and complete proposals based on the service definitions, engineering factors and public policy goals adopted in this proceeding far outweigh any effect on the current applicants. For these reasons, the Commission should accept additional DARS applications.

III. THE EXISTING APPLICANTS HAVE NOT ADEQUATELY ADDRESSED OVERALL AVAILABLE CHANNEL CAPACITY AND NUMBER OF POTENTIAL LICENSEES

The four applicants, in their comments, have asserted that the 50 MHz allocated to DARS can be divided into 12.5 MHz segments and that each segment will provide sufficient channel capacity for the applicants' proposed services. However, the more important issue of the total capacity latent within the 50 MHz spectrum allocation has not been adequately addressed or analyzed in the record of this proceeding as it now stands.

The earliest assertion of total channel capacity was made by CD Radio in its initial application, citing the need for 60 MHz of spectrum to provide 100 CD

quality channels. 10/ Since that 1990 filing, CD Radio has revised its estimates and now asserts that 50 MHz can provide 140 channels. Coupled with this capacity estimate is the assertion that a DARS operator must have between 30-40 channels in order to provide an economically viable, subscription-based service. From these estimates, the 12.5 MHz allocation per applicant is derived as the basis for four 35-channel systems.

DSBC agrees with CD Radio's estimated that 12.5 MHz will allow provision of 35 channels. 11/ Primosphere does not address the question of upward limits of channel capacity, asserting instead that they will provide 19 near-CD quality channels and 7-9 voice-quality channels and that those channels can be accommodated by a 12.5 MHz allocation. 12/

Among these three applicants there appear to be varying assumptions regarding bit rates, system designs, encoding techniques, etc., that could significantly affect the ultimate channel capacities of the respective systems. For example, CD Radio assumes that 256 Kbps are required for CD-quality

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10/ See Application of Satellite CD Radio, Inc., File Nos. 49/50-DSS-P/LA-90 (May 18, 1990) at 10, 12

11/ See Comments of Digital Satellite Broadcasting Corporation at 31, 37.

12/ See Comments of Primosphere Limited Partnership at 6.

transmissions; however, DSBC and Primosphere assume 128 Kbps and 384 Kbps, respectively. 13/

The need for the Commission to have more complete information on the issue of potential channel capacity is illustrated by the fact that AMRC's proposed system may offer materially greater capacity than the other applicants. AMRC states that its system design will allow between 36 and 44 channels per 12.5 MHz. 14/ That capacity would permit between 144 to 176 channels if implemented over the entire 50 MHz allocation. If the upper limit of the AMRC system were duplicated on all DARS systems, then the 50 MHz allocation could comfortably accommodate a fifth licensee, assuming that the requirement of 35 channels per licensee is valid.

13/ See Amendment to Satellite System Proposal of Satellite CD Radio, Inc., File Nos. 58/59-DSS-AMEND-90 (October 17, 1990), Exhibit 1, at 5; Application of Digital Satellite Broadcasting Corporation, File Nos. 28-DSS-LA-93, 12/13-DSS-P-93 (December 15, 1992), Section A, at 5; Application of Primosphere Limited Partnership, File Nos. 29/30-DSS-LA-93, 16/17-DSS-P-93 (December 15, 1992) at 29.

14/ See Comments of American Mobile Radio Corporation at 25.

IV. AT LEAST SIX DARS OPERATORS CAN BE ACCOMMODATED IN THE ALLOCATED SPECTRUM

A. Thirty Channels Can Be Carried In An 8.32 MHz National Beam In A TDM Mode Or Thirty-Two Channels In An 8.32 MHz National Beam In A CDM Mode Or Even More Channels In Either Mode If A Higher Order Modulation Is Feasible

In its initial Comments in this proceeding, Cracker Barrel presented data supporting a regionalized licensing scheme based on the use of CDMA in a ten spot beam configuration. 15/ The data showed that as many as fifteen regional licensees could be accommodated within this format. 16/

Cracker Barrel notes that a study in CD Radio's initial Comments concludes that thirty-five channels could be multiplexed in each of four 12.5 MHz bandwidths, apparently using TDM with QPSK modulation in a single national beam. 17/ Cracker Barrel asked Dr. Laurence Milstein, an expert in advanced radio transmission technologies, to comment on this conclusion. 18/ Dr. Milstein concludes that using TDM, thirty channels can be accommodated in 8.32 MHz.

15/ Digital Satellite Broadcasting Corporation also employed spot beams (along with national beams) and CDMA in their proposal.

16/ We clarify that the large number of licensees would be made possible primarily because of the use of multiple spot beams.

17/ No explicit statement concerning the capacity of a system based on TDM was presented by CD Radio. But the last paragraph on page 15 of its engineer's comments suggests that 35 CD channels can be supplied in 12.5 MHz using TDM. Comments of CD Radio, Appendix B, at 15.

18/ Dr. Milstein's comments are attached as Appendix A, hereto. His curriculum vitae is attached as Appendix B.

Thus, six operators could be accommodated within the available bandwidth, two more than the current number of applicants.

Cracker Barrel further notes that CD Radio concludes that thirty-three channels could be multiplexed in each of four 12.5 MHz bandwidths using CDM. 19/ Dr. Milstein demonstrates that at least 6 operators, with 32 CD channels each, can operate in the 50 MHz bandwidth using CDM. Again assuming the use of a QPSK modulation, if each symbol is spread by a factor of 32, then the resulting bandwidth is 8.064 MHz. Therefore, 32 binary orthogonal waveforms can be used as the spreading sequences and 32 CD channels can be supported. Because the available 50 MHz bandwidth can be divided into six disjoint segments of 8.32 MHz apiece, a total of six service providers, each with 32 CD channels, can operate simultaneously using CDM.

But Dr. Milstein questions CD Radio's assumption that QPSK is the most efficient modulation technique for digital audio satellite radio in either a TDM or a CDM mode. Dr. Milstein points out that the use of a higher order modulation constellation, such as 16-QAM, would double the number of channels available (and thus the potential number of licensees). The CD Radio study recognizes this fact as well, but rejects the possibility of using the higher order modulation because higher satellite power would be required. Dr. Milstein acknowledges that the use of 16-QAM would require more power than QPSK. However, the cost implications of this

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19/ Comments of CD Radio, Appendix B, at 10-11.

power increase should be determined, since a major public policy issue in this proceeding -- the number of channels the allocated bandwidth will support -- turns on this factor.

B. The Number Of Operators That May Be Licensed Turns On Assumptions About How Many Channels Are Economically Necessary Per Licensee

Another matter relevant to the issue of how many licensees the bandwidth will support is the minimum number of channels assumed to be necessary for an economically viable operation. The Commission's conclusion about this number is crucial because even a small reduction in the number of channels assigned per licensee will significantly increase the number of operators who can be accommodated.

None of the applicants or commenters, except CD Radio, have provided the Commission with independent evidence or analysis that substantiates how many channels may be required in order to ensure economic viability for a given DARS system. The applicants have made self-interested assertions regarding this issue, but have not offered market tests or economic analyses based on empirical data to support those assertions.

Most of the applicants confuse this question of minimum channels required for economic viability with the number of channels that their proposed systems may be able to carry, implying that system capacity in the engineering sense is equivalent to the number of channels needed for economic viability. Those issues may, in fact, be independent of one another.

CD Radio does provide a concrete example of a service from which conclusions on this issue of minimum channel requirement may be drawn. "Cable radio" is offered as the "most directly comparable" service to DARS. CD Radio asserts that the channels offered by cable radio service providers indicate the number of DARS channels required for economic viability. However, the analogy between DARS systems and cable radio services may not be sufficiently relevant or robust to support a conclusive finding on this matter.

CD Radio states that DMX and Music Choice both entered the market providing 30 channels of CD-quality subscription music. Subsequently, both companies have increased their service to 60 channels with plans underway for expansion to 120 channels. CD Radio then goes on to "recount briefly" the history of DMX, saying no more about Music Choice as it is offered as part of a basic DBS service package rather than as a stand-alone subscription and, presumably, is not relevant or not useful to CD Radio's analysis. Consequently, on the basis of only DMX's experience, CD Radio assets that the necessary critical mass of formats for a subscription-based service is at least 30 channels.

While cable radio services may provide useful indicia of market acceptance of and demand for CD-quality music services, those services differ from the proposed DARS services in matters such as target audiences, formats, system characteristics, underlying costs, etc. As a threshold matter, while DMX's subscription services may be analogous to CD Radio's proposed subscription services, they are arguably not a useful indicator of market acceptance of advertiser-based DARS offerings as proposed by Primosphere. Similarly, the

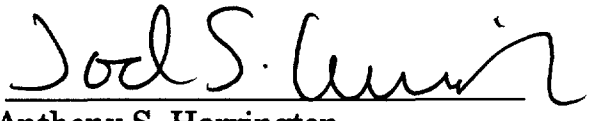
degree to which DMX's experience may be pertinent to a mixed advertisement and subscription offering such as that of AMRC cannot be accurately gauged from the information disclosed in CD Radio's filing. A proper understanding of the implications of cable radio's experiences requires much more data and analysis than has been offered by CD Radio and DMX.

V. CONCLUSION

In order to ensure that the public will receive the full benefits of satellite-delivered digital audio radio, the Commission should create the DARS service; reopen the previous application filing window; and authorize the maximum number of licensees permitted by the use of TDM or CDM.

Respectfully submitted,

CRACKER BARREL OLD COUNTRY STORE, INC.

By: 

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APPENDIX A

COMMENTS OF
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Use of TDM

If TDM is used as the multiplexing format, the efficiency of a saturating satellite repeater can, in principle, be taken advantage of, since only a single signal is present in the repeater at any instant of time, and thus one does not need to be concerned about generating intermodulation distortion. However, the above statement is only true if a constant envelope waveform is being used.

Since the system of interest is bandwidth-limited, some type of bandwidth efficient modulation is desirable, either in the form of bandwidth efficient pulse shaping or higher order modulation formats. In either case, one must back off from the assumption of a saturating repeater, and instead run the repeater in a linear mode. Once this is done, either, or both, of the above two options can be used. Considering first the former option, one can, for example, use raised-cosine pulses for the waveshaping. Specifically, if we assume an encoded data rate of 420 Kbps is adequate for CD-quality music (corresponding to an information rate of 128 Kbps, an overhead of 10% for a net rate of 140 Kbps, and a rate 1/3 code), and if we assume QPSK modulation in conjunction with a raised-cosine pulse having an excess bandwidth of 30%, then the total number of CD channels in a bandwidth of 8.32 MHz is about 30. Since 50 MHz can be divided

into six disjoint segments of 8.32 MHz apiece, this implies that six service providers can simultaneously operate.

Use of CDM

Alternately, again under the assumption of a backed-off repeater, we can consider a CDM multiplexing format. The advantage here would be that we can now be more aggressive with the filtering, since we are filtering the chips rather than the symbols. For example, if we assume a 20% excess bandwidth, in 8.32 MHz we can support 32 CD channels. That is, with an encoded data rate of 420 Kbps, a 20% excess bandwidth requires 252 KHz of spectrum, assuming QPSK modulation is used. If each symbol is now spread by a factor of 32, the resulting bandwidth is 8.064 MHz. Therefore, 32 binary orthogonal waveforms can be used as the spreading sequences, and 32 CD channels can be supported. As noted in the previous paragraph, since 50 MHz can be divided into six disjoint segments of 8.32 MHz apiece, what this implies is that in 50 MHz, a total of six service providers can again simultaneously operate, but this time with 32 CD channels apiece rather than 30. Further, there will be 256 KHz of bandwidth remaining for other use, such as guardbands.

Use of Higher Order Modulation Constellations
with TDM or CDM to Increase the Number of CD Channels

To noticeably increase these numbers with either TDM and CDM requires a higher order modulation constellation. For example, if 16-QAM was to be employed by all applicants, the number of service providers could double. The

penalties, of course, are an increase in transmit power to compensate for the greater Eb/No required by the larger modulation constellation, and an increased amplifier size needed to overcome the loss in efficiency inherent with running the amplifier in a linear mode.

These penalties are not likely to be trivial ones; however, the potential gain in capacity is also nontrivial and should not be overlooked. Therefore, it is suggested that the applicants present a detailed study to the FCC showing why QPSK was chosen as the proposed modulation format, and, in particular showing why a higher order signal constellation (e.g., 16-QAM as opposed to QPSK) should not be adopted.

APPENDIX B

RESUME OF LAURENCE B. MILSTEIN

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EDUCATION

B. S. (E.E.) City College of New York, 1964

M. S. (E.E.) Polytechnic Institute of Brooklyn, 1966

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EXPERIENCE

1976-Present	University of California, San Diego, Department of Electrical and Computer Engineering
	1984 - 1988 Department Chair
	1982 - Present Professor
	1979 - 1982 Associate Professor
	1976 - 1979 Assistant Professor
1974-1976	Rensselaer Polytechnic Institute, Department of Electrical and Systems Engineering
	Assistant Professor
1968-1974	Hughes Aircraft Company, Space and Communications Group
	1972 - 1974 Senior Staff Engineer
	1969 - 1972 Staff Engineer
	1968 - 1969 Member of Technical Staff

CONSULTING EXPERIENCE

Radar systems analysis
Aerospace Group, Hughes Aircraft Company

Spread spectrum communication
- Robert Gold Associates
- Lockheed Missiles & Space Company
- U.S. Army CORADCOM, Fort Monmouth
- SCS Telecom
- Comstream
- Millicom, Inc.
- InterDigital Communications Corporation
- Motorola Satellite Communications

Adaptive equalization techniques
- Rome Air Development Center

Modulation techniques for satellite and digital radio communication
- National Telecommunications and Information Agency
- Cellular Telecommunications Industry Association
- National Center for Atmospheric Research

PROFESSIONAL ACTIVITIES AND ACADEMIC HONORS

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NASA Predoctoral traineeship (Sept. 1964 - Sept. 1967).

Polytechnic Institute of Brooklyn Special Research Fellow (Sept. 1967 - Jan. 1968).

Associate Editor for Communications Theory for IEEE Transactions on Communications (June 1977 - June 1984).

Program Chairman for 1973-74 Los Angeles chapter of IEEE Information Theory Group.

Chairman, Ninth Annual Communication Theory Workshop, April 1979, Trabuco Canyon, California.

Publication Chairman, International Symposium on Information Theory, February 1981, Los Angeles, California

Associate Editor, IEEE Communications Magazine (March 1980 - June 1984).

Co-Guest Editor of special issue of IEEE Transactions on Communications on Spread Spectrum Communications, May 1982.

Technical Program Co-Chairman, Twelfth Annual Communication Theory Workshop, April 1982, Wickenburg, Arizona.

Treasurer, International Symposium on Information Theory, June 1982, Les Arcs, France.

Technical Program Co-Chairman, 1982 IEEE Military Communications Conference, October 1982, Boston, Massachusetts.

1982 Outstanding Teacher of Warren College, UCSD.

Member of Board of Governors, IEEE Communications Society, 1983, 1985 - 1987, 1993- 1995.

Fellow, IEEE, 1985.

Chairman, MILCOM Conference Board, 1986.

Chairman, Eighteenth Annual Communication Theory Workshop, April 1988, Sedona, Arizona.

Co-Chairman, 1990 International Symposium on Information Theory, January 1990, San Diego, California.

Member of Board of Governors, IEEE Information Theory Society, 1989 - 1991, 1992 - 1994.

Vice President for Technical Affairs, IEEE Communications Society, 1990-91.

Co- Guest Editor of two special issues of IEEE Journal on Selected Areas in Communications Spectrum Communications, May and July, 1990.

Associate Editor for Book Reviews, IEEE Transactions on Information Theory, 1991.

Technical Program Chairman, 1992 IEEE Military Communications Conference, October 1992, San Diego, California

Chairman, Communication Theory Technical Committee, IEEE Communications Society, 1993 - 1995.

Senior Editor, IEEE Journal on Selected Areas in Communications, 1993 - 1995.

BOOKS

Co-editor of Tutorials in Modern Communications, Computer Science Press, 1983.

Co-editor of Spread Spectrum Communications, IEEE Press, 1983.

CERTIFICATE OF SERVICE

I, Kathy Bates, a legal secretary with the law firm of Hogan & Hartson L.L.P., hereby certify that on this 13th day of October, 1995, a copy of the foregoing Reply Comments of Cracker Barrel Old Country Store, Inc. was mailed by U.S. first class mail, postage prepaid, to the parties listed on the attached service list.

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Dated: October 13, 1995

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